

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE

MULTIPLE CONNECTOR (LCVG HALF), ITEM 107	2/1R	107FM16 External water leakage when coupled.	END ITEM: Water leakage into suit vent loop.	A. Design - The MWC is designed to have zero leakage when coupled. This is accomplished by using smooth machined inner surfaces, tight tolerances, polylube coating, Krytox grease, and a series of "O" rings which seal all possible leak paths. The multiple connector and the plug ends are machined from 6061-T6 aluminum. The external sealing surface is machined to a 63 finish and the plug ends to a 16 finish. The compression spring is tempered stainless steel, "O" rings are silicone rubber and the hose clamp is machined from 7075-T73 aluminum. All screws are high strength alloy steel.
A/L 9693-03 (1)		Defective Material: Deteriorated O- ring; loose or missing hose clamp screws.	GFE INTERFACE: Loss of water from water reservoir. Possible fogging of helmet.	The multiple connector three hose clamp is designed to minimize the cold flow characteristics of EVA tubing and thereby ensure the longevity of positive sealing. This is accomplished by machined grooves on the clamping surface. Leakage at the multiple connector/EVA tubing interface is precluded by the three hose clamp and by torquing of clamp attachment screws to 7-9 inch lbs. Teflon penetrated hard coat anodize (polylube) finish provides a self-lubricating, high corrosion - resistance surface with a minimum finish of 63 on which Krytox lubricated o-rings seal. A 30 degree x .045 edge break is specified on the leading edge of the HUT plug end to prevent damaging the LCVG o-ring during mating. All sliding surfaces are coated with Krytox grease.
CLAMP A/L 9697-04 (1)		Contamination or corrosion.	MISSION: Terminate EVA. Loss of use of one EMU. CREW/VEHICLE: None with single failure. Loss of crewman with loss of SOP.	Introduction of contamination as a cause of leakage is prevented by the wiping action of the HUT side multiple connector "O" ring along the LCVG connector housing sleeve during engagement. A redundant wiping action is provided by the LCVG multiple connector "O" ring to further eliminate the introduction of contamination.
			TIME TO EFFECT /ACTIONS: Seconds. Activate the purge valve and return to airlock.	Stainless steels are passivated to remove residual corrosive elements. This combination of proper material selection and surface treatment makes corrosion an unlikely source of leakage.
			TIME AVAILABLE: Minutes.	B. Test - Acceptance - The MWC is subjected to testing per Airlock ATP 9693/9697 at Airlock with ILC source verification. The LCVG-MWC is pressurized to 33.0 psig for 10 minutes. The connector is mated with the HUT side MWC, pressurized to 33.0 psig and held for 10 minutes, minimum. Leakage is tested at 17.7 psig with the MWC mated and unmated. Engagement force with the HUT side MWC at 15 psig and the LCVG MWC at 17.7 psig is tested with force not to exceed 30 lb.
			TIME REQUIRED: Seconds.	PDA: The following tests are conducted at the LCVG Assembly level in accordance with ILC Document 0111-70028J:
		REDUNDANCY SCREENS: A-PASS B-PASS C-PASS		Multiple connector engagement force test to verify source does not exceed 30 lbs. Engagement cycling to verify the connector engagement function. Initial leakage test to verify no visible leakage at 240 pph minimum flow at 17.7 psig maintained for at least 30 minutes. Proof pressure test to verify no structural damage with cooling tubes charged at 33 psig for not less than 10 minutes. Post proof leakage test verification for no visible leakage at 240 pph minimum flow at 17.7 psig maintained for at least 30 minutes. Spillage test at 17.7 psig to verify spillage not to exceed 2.0 cc.

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107FM16

Certification:

The LCVG hardware was successfully tested (manned) during SSA certification to duplicate operational life (Ref. ILC-EM-83-1083). The following usage, reflecting requirements of significance to the LCVG, was documented during certification.

Requirement	S/AD	Actual
Don/Doff	98	502
Pressurized Cycles	300	1369
Hardware Actuations	300	1080

The LCVG softgoods were successfully tested (manned) during SSA certification to duplicate operational life (Ref. ILC-EM-98-0008). The following usage, reflecting requirements of significance to the LCVG, was documented during certification.

Requirement	S/AD	Actual
Don/Doff	98	400

C. Inspection -

Components and material manufactured to ILC requirements at an Approved Supplier are documented from procurement through shipping by the supplier. ILC incoming receiving inspection verifies that the hardware received is as identified in the procurement documents, that no damage has occurred during shipment and that supplier certifications have been received which provide traceability information.

The following MIP's are performed during the MWC manufacturing process to assure the failure cause is precluded from the fabricated item:

- Inspection for cleanliness to VC level.
- Inspection after proof and leakage testing for deformation, defects or damage.
- Verification of Multiple Water Connector engagement force.
- Verification of spillage upon disengagement of connector halves.
- Verification of application of Krytox grease to the "O" rings.
- Verification of presence of screws during torquing.

During PDA, the following inspection points are performed at the LCVG Assembly level in accordance with ILC Document 0111-70028J:

- Inspection for cleanliness to VC level.
- Verify Multiple Connector engagement force does not exceed 30.0 lbs (5 cycles).
- Verification of a maximum of 2.0 cc spillage during Multiple Connector spillage test.

D. Failure History -

B-EMU-107-A007 (4/16/92) - The LCVG Multiple Water Connector exhibited external leakage (approx. one drop per minute) while mated to the test stand. The failure cause could not be determined. No corrective action taken.

E. Ground Turnaround -

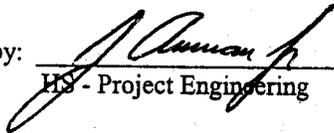
Tested per FEMU-R-001, LCVG Pre-Flight Test Requirements, Structural and Leakage Test.

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		107FM16		Every 369 days clean and lubricate Multiple Water Connector and replace o-rings. F. Operational Use - Crew Response - Pre/post-EVA : Troubleshoot problems, if no success, use spare LCVG if available. Otherwise terminate EVA operations. EVA : If significant amounts of water detected, deactivate fan, open purge valve, terminate EVA. Special Training - Standard EMU training covers this failure mode. Operational Considerations - EVA checklist procedures verify hardware integrity and systems operational status prior to EVA. Flight rules define go/no-go criteria related to EMU ventilation flow. Real time data system allows ground monitoring of EMU system.

EXTRAVEHICULAR MOBILITY UNIT
SYSTEMS SAFETY REVIEW PANEL REVIEW
FOR THE
I-107 LIQUID COOLING & VENTILATION GARMENT (LCVG)
CRITICAL ITEM LIST (CIL)

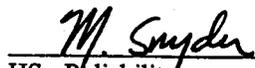
EMU CONTRACT NO. NAS 9-97150

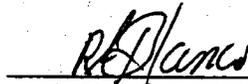
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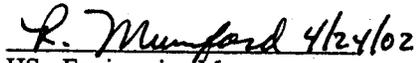

HS - Project Engineering

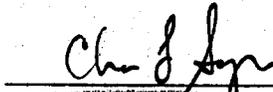
Approved by:


NASA - SSA/SSM

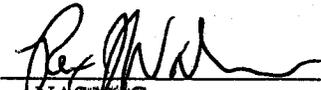

HS - Reliability


NASA - SSA/SSM

 4/24/02
HS - Engineering Manager


NASA - S & MA


NASA - MOD


NASA - Crew

 7/19/02
NASA - Program Manager